APPLICATION FOR LETTERS PATENT

FOR

CABLE OPERATED AUTOMATIC POOL COVER SYSTEM USING BUOYANT-SLAT POOL COVERS

INVENTOR: HARRY J. LAST

Prepared by:

Robert J. Schaap, Esq.
21241 Ventura Boulevard
Suite 188
Woodland Hills, CA 91364
(818) 346-6555

SPECIFICATION

BE IT KNOWN THAT I, HARRY J. LAST, a citizen of the United States and resident of the City of Kailua, State of Hawaii, have invented a certain new and useful improvement in a CABLE OPERATED AUTOMATIC POOL COVER SYSTEM USING BUOYANT-SLAT POOL COVERS of which the following is a specification containing the best mode of the invention known to me at the time of filing this application for letters patent therefor.

RELATED APPLICATION

This application is based on and claims priority from provisional application Serial No. 60/196,562, filed April 11, 2000, for Buoyant Slat Pool Cover Systems.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to certain new and useful improvements in an automatic pool cover system utilizing cable drives for controlling wind-up and payout of a buoyant slatted swimming pool cover from a cover drum.

2. Brief Description of Related Art

Pool covers are frequently used on swimming pools inasmuch as they provide an energy savings, keep the swimming pool relatively clean and minimize the use of chemicals to maintain safe swimming pool water. In addition, and more importantly, they are widely effective in providing additional safety features. In windy locations, a swimming pool cover is essential for maintaining pool water at a comfortable temperature and for eliminating debris which might otherwise be blown into a swimming pool.

The vast majority of swimming pool covers use electrically operated using electric motor drives. However, electric motor drive systems present numerous safety hazards and, moreover, the electric motors must be completely insulated from a water environment. Even when the pool cover drive systems are located in a separate subterranean environment in proximity to the swimming pool, rain water and other water from the swimming pool itself tends to collect in the subterranean compartment which is used for housing the electric motors and associated electrical components.

Moreover, it has been recognized that at least fifty percent of failures in most automatic pool cover systems is the result of the inherent problem of water damage.

In order to overcome this problem, the present applicant designed and developed a pool cover system which totally relies upon a hydraulic drive located at or near the swimming pool. An electric power pack is provided at a remote location for pumping the hydraulic fluid. One such system is described in U.S. Patent No. 5,184,357, dated February 9, 1993, in which the applicant describes an automatic swimming pool cover using a hydraulic drive for providing cover drum rotation during extension and rotating the cover drum for cover retraction.

Automatic swimming pool cover systems frequently use flexible vinyl fabric which is sized so that it floats on the surface of the pool water. The water acts as a low friction surface reducing the amount of force required to drag the cover across the swimming pool. However, many swimming pool covers, both in the United States and elsewhere, use the buoyant slat type pool cover. This pool cover includes a plurality of interconnected buoyant slats which effectively float on the surface of the water. Moreover, the cover drum for these slatted type pool covers is usually located in a submerged condition in the body water forming the swimming pool. In these cases, electric drive systems are not effective because of the problems mentioned above.

The present applicant has proposed and has designed a pool cover system for relatively rigid buoyant slatted pool covers which

relies upon a hydraulic drive. The hydraulic drive is powered by an electrically operated power pack in a remote location. The present invention relies totally upon a cable system which is powered from a remote location and, therefore, the drive can be either an electric drive, a hydraulic drive or the like.

Automatic pool cover systems utilizing interconnected rigid buoyant slats which roll up on a submerged or elevated drum are also described in U.S. Patent No. 3,613,126 to R. Granderath and are quite popular in the United States and also in Europe. These pool cover systems utilize passive forces arising from buoyancy or gravity to propel the cover and extend the cover across the swimming pool. However, there must be some mechanism to prevent the retracted cover from unwinding responsive to these passive forces. Granderath provides a worm gear drive mechanism for winding the cover and preventing cover drum rotation when not powered. However, worm gear drive mechanisms are not effective and insufficient for the intended purposes.

There has been a need for a pool cover system in which a swimming pool cover can be driven across a swimming pool to a closed position and wound back onto a cover drum in order to an opened position in order to provide access to the swimming pool and which could be powered completely from a remote location. The present invention finds its employment in a cable drive in which the power source can be remotely located.

BRIEF SUMMARY OF THE INVENTION

A desirable solution for the buoyant slat type cover would be to provide a cover drum located in a submerged condition in a swimming pool for wind-up of the cover onto the drum and for unwinding of the cover from the drum. A cable drive system is effective for powering the drum to roll the cover back onto the cover drum in order to provide access to a swimming pool and for controlling the speed of unwinding of the cover from the drum as a result of buoyant or gravitational forces.

In accordance with the present invention, a cable drum is located at a remote location and is powered from a separate power source at that remote location. The power source could be either an electric motor or a pneumatic drive motor or any other type of motive means. The cable drum is also trained about a separate cable drum mounted on the cable drum shaft which carries the cover. Thus, cable can be pulled from the cable drum on the cover drum shaft and also wound onto the powered cable drum. In like manner, speed of movement of payout of the cable from the powered cable drum can be controlled by a brake means at a remote location to thereby control any unwinding of the cover from the cover drum.

The drive system of the invention utilizes the extensive upward buoyant force of the cover and its ability to cover the swimming pool and converts this force into a usable controllable drive means. In the present invention, the system employs a stainless steel cable or other non-corrosive cable or force

transmitting means and winds this cable onto the cover drum or, otherwise, to a separate reel attached to the cover drum while the cover is being propelled across the swimming pool by its own inherent buoyant force. In this case, the drum pays out the cable at a controlled and essentially constant rotational speed by a winch-like means operated either by a hydraulic or electric motor at a location remote from the swimming pool.

On a floating slat type of cover there are many applications where the cover drive system must be placed well below the surface of the water in order to prevent interference with other pool construction such as pools with continuous gutters and overflow weirs. Also in instances where two covers unwind from the center of the pool as described in the Granderath patent EP 369038 the drive system must necessarily be mounted in bottom of the pool to be out of the way of swimmers while the pool is being used. Another reason is that sometimes pool covers are fitted to existing pools and for convenience and aesthetics the cover drum is placed at the bottom of the pool. These cover systems are typically powered by penetrating the cover drum drive shaft through the pool wall with a shaft sealing system. This means that an accessible maintenance chamber on the other side of the pool wall must be constructed at the full depth of the pool or more, and at considerable expense. Furthermore, the rotating shaft seals at these depths must be more substantial so as to prevent leakage of water from the pool at the higher pressures. Another possibility is to use a chain drive coupled to a drive enclosure just above the

surface of the water. Stainless steel chain drives are costly and furthermore over the distances used, they need idlers to keep the chain tight. For safety reason, in some applications guards are also required, which take up space.

Recently cover drive drums have been available which incorporate an electric motor inside of the drum. Typically these drives incorporate a planetary gearing system. Since unlike worm gear reducers, these planetary gear systems do not prevent back driving or self braking, they must have a friction brake incorporated to stop the cover at any time. Furthermore, these brakes are strictly an off/on brake and do not counterbalance the natural buoyant force of the cover when unwinding and will not control acceleration. Typically some type of additional electrical motor braking is required. These internal drum motors are considerably more expensive and require good sealing for the electrical supply and control wires especially at greater depth and pressures. A further problem is that the electrical braking must necessarily dissipate the energy generated as heat. This causes thermal expansion and escape of air through the seals in heating, and which will, in turn, subsequently pull in water through the seals because of the vacuum created when the cover drum cools. This water in an electrical environment eventually can be disastrous on the reliability of the electrical components inside the cover drum.

One of the consequences of placing the cover well below the surface of the water is that more of the buoyant cover is

submerged and creates a greater buoyant force. For example on a typical 20 feet wide by 40 feet long swimming pool, with the roller beneath the pool floor, the torque on the drive shaft can be as high as 6000 inch-pounds in the fully open position, or conversely an upward force of 600 lbs acting on a ten inch lever arm. This torque reduces to about 1800 inch-pounds at the completely closed position and the moment arm is reduced to about three inches. Buoyant covers, particularly covers well submerged below the surface of the water, have enough inherent buoyant energy in the unwinding or covering direction to cover the pool without any input of energy from any external source. In fact, it has been the experience that the cover will accelerate to such a linear covering speed as to cause buckling of the cover and other problems with control. For this reason braking is provided in the unwinding or covering direction to prevent acceleration and maintain a reasonable covering velocity.

Another problem with direct drive to the cover drum for the floating cover is that there is no provision or means to detect if a problem had occurred with interference or blockage of the cover as it travels while floating across the pool. Consequently, when such a blockage occurs the cover drum will continue rotating and unwinding causing the cover to bunch up in the well and often causing severe and frequent irreparable damage to the cover slats. Considerable work is required to untangle the jammed and damaged cover materials.

This invention possesses many other advantages and has other purposes which may be made more clearly apparent from a consideration of the forms in which it may be embodied. These forms are shown in the drawings forming a part of and accompanying the present specification. They will now be described in detail for purposes of illustrating the general principles of the invention. However, it is to be understood that the following detailed description and the accompanying drawings are not to be taken in a limiting sense.

BRIEF DESCRIPTION OF THE DRAWINGS

Having thus described the invention in general terms, reference will now be made to the accompanying drawings in which:

Figure 1 is a fragmentary schematic perspective view, partially broken away, showing one form of automatic pool cover system in accordance with the present invention; and

Figure 2 is a fragmentary schematic perspective view, partially broken away, and showing a modified form of automatic pool cover system in accordance with the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now in more detail and by reference characters to the drawings, there is illustrated in Figure 1 an overall automatic pool cover system in combination with a swimming pool. This pool cover system specifically shows the drive mechanism in a subaqueous condition and with a special subterranean compartment as hereinafter described.

More specifically, there is illustrated a pool deck 70 surrounding a swimming pool wall 72 and which provides an interior swimming pool cavity 74 containing water therein. The automatic pool cover mechanism is located in a separate subterranean compartment 76 formed by a subterranean wall 78, as shown. A pool cover lid 80 is disposed over the compartment 76 and provides access thereto.

A cover dispensing and winding mechanism 82 is provided and includes a subaqueously located cover drum 84. Generally, the cover dispensing and winding mechanism 82 is located in its own separate compartment for easy access and for purposes of cleaning and repair.

By further reference to Figures 1 and 2, it can be seen that the cover drum 84 is mounted on a drum shaft 90 which projects through a sealed aperture 91 in the wall 78, and which is also hereinafter described in more detail. The drum shaft may also be contained in an interior compartment and mounted to the inside of the pool wall. A buoyant slat type cover 92 is wound upon the

cover drum and may be unrolled therefrom to extend over the upper surface 94 of a swimming pool body of water.

Also mounted on the drum shaft 90 and being co-axial with the drum 84 is a cable reel 96 and which receives a cable 98. The cable 98 is trained about a cable spool 100 which is, in turn, coupled to and driven by a motor 102. It can be observed that the motor has an output shaft 104 which is connected to a worm gear reducer 106, the latter of which serves to provide a braking action to the cover drum. The reducer 106 is mounted to the cable spool 100 for rotating same. Since the steel cable may be as thin as two or three millimeters, the reel could be mounted on the inside of the pool wall. At approximately twenty revolutions of the drum to close the pool, a three to four layer cable buildup would amount to a cable reel width of only eight to 10 millimeters.

The motor 102 can be any type of power drive as, for example, an electrical motor, or a hydraulic motor, or the like. It is only important to provide rotating power to the spool 100 upon a driving command. It should also be observed that the cable spool 102 and the drive motor 102 is remotely located with respect to the pool cover mechanism 82. In this way, the cable can be trained through a wall or other structure and connected to the spool 100 when the latter is in a remote location.

The cover which is used in the system of the present invention is preferably a buoyant type cover comprised of a plurality of interconnected buoyant slats. When this cover is wound onto a drum, particularly when the latter is in a submerged condition, as

shown in Figure 1, the diameter of the drum will increase. The torque on the drum shaft 90 increases and is the product of the upward buoyant force of the slat area unwound from the cover drum and still submerged beneath the surface of the water multiplied by the instant radius of the cover drum. It can be observed that there is a buoyant force and/or gravitational force which causes the cover to unwind from the drum and thereby travel across the swimming pool. Thus, the cover will literally drive itself across the swimming pool to the closed position, although some braking means must be provided to control the speed of the cover drum and thereby preclude the cover from contacting an end position with any substantial force which would damage the cover. However, in order to wind the cover upon the drum to thereby open the cover, a driving force is required and that driving force is provided by the cable through the driven cable spool 100.

One means to brake the cover drum in the unwinding direction, when the cover is moving to the closed position, is a worm gear reducer, as shown. Another means, such as a ratchet and pawl mechanism, can also be used. In this case, the ratchet and pawl mechanism would be connected to a shaft extending from the opposite side of the spool 100. In this way, the pawl engages the ratchet and precludes unwinding of the cover from the spool. Moreover, the ratchet and pawl does not provide a braking action, as such.

In place of a worm gear reducer or a ratchet and pawl, it is possible to use a conventional braking mechanism, such as a disc (not shown), engaged on the shaft and engaged by brake shoes,

similar to that shown in Figure 2. For this purpose, any type of braking mechanism may be employed in accordance with the present invention.

It can be observed that when the cover is unwinding from the drum, it will cause an unwinding of the cable 98 from the spool 100 and which will thereupon wind onto the reel 96. In addition, when it is desired to wind the pool cover onto the drum, the motor 102 is energized causing rotation of the spool 100 and the causing the cable 98 to rotate the drum shaft 90 as well as the reel 96 and the cover drum 84.

One of the principle problems in operating a cover drum when the latter is in a subaqueous condition is the fact that necessary precautions must be taken to preclude water from contacting the actual drive mechanism, such as an electric motor or hydraulic motor. Usually, this requires formation of separate compartments and sealed openings through which a drum shaft would extend. Notwithstanding, and even with these precautions, water still tends to collect in the drive compartment.

In accordance with the present invention, it is possible to run the cable through any subterranean structure or other structure so that it does not encumber access to the swimming pool itself. In this case, the cable 98 is shown as being trained around the reel 96 and over an idler roller 112 through a retaining tube 114 to the spool 100. As indicated previously, the spool 100 and any drive motor, such as the motor 102, would be located in a completely remote position and thereby insulated from any potential

hazards of water. This system is easy to install and relatively inexpensive. Moreover, its simplicity provides simple operation and relatively trouble free operation. Most importantly, it solves the problem of attempting to power a drum shaft, such as the drum shaft 90, without compromising the safety of the power source.

Figure 2 illustrates an alternate embodiment of the present invention. In this case, reference numerals used to identify those components in Figure 1 will be used to identify like components in Figure 2.

In the embodiment of the invention as shown in Figure 2, there is a conventional brake mechanism 120 which is used in place of the worm gear reducer 106. In this case, there is provided a brake disc 122 acted upon by brake shoes 124. A suitable control mechanism would be provided for operation of the brake mechanism. In this way, a braking force can be provided, if desired.

Also in the embodiment of the invention as illustrated in Figure 2, a second reel 126 is also mounted on the drum shaft 90 adjacent to the spool 100. The spool 100 continues to pay out and receive the cable 98. However, a second cable 128 is trained about the second reel 126, also in the manner as shown in Figure 2. The second cable 128 similarly winds up onto the reel 100. Moreover, it can actually be continuous with the cable 98, if desired.

In accordance with the above-identified construction, it can be observed that a controlled drive is provided in both directions, that is, the first cable 98 would provide a positive drive to roll cable onto the drum. The second cable 128 provides a controlled

rotation of the drum shaft 90 and, hence, the drum 84, and thereby provides a controlled payout of the cover 92. This mechanism is highly effective, particularly when used with a brake mechanism, such as the mechanism 120.

The system as illustrated in Figure 2 is equally as effective as the system in Figure 1, in that the power source and the spool are located in a remote location with cables again being trained in an underground structure or other structure where the cable is unobtrusive. Thus, the cable drive of the invention provides a very effective means, both for providing driving power for winding up the cable and also for providing a braking power to the cover.

It should be understood that the aforementioned system may also be applied to systems where rollers are placed above the water surface and subject to gravitational as opposed to buoyant forces. This arrangement would be equally effective.

Thus, there has been illustrated and described a unique and novel cable operated automatic pool cover system using buoyant slat pool covers and which thereby fulfills all of the objects and advantages which have been sought. It should be understood that many changes, modifications, variations and other uses and applications which will become apparent to those skilled in the art after considering the specification and the accompanying drawings. Therefore, any and all such changes, modifications, variations and other uses and applications which do not depart from the spirit and scope of the invention are deemed to be covered by the invention.